

REMARKS

Claims 1-14 and 19-20, and 23-26 are pending in the subject application. Claims 21 and 22 have been cancelled herein without prejudice. New Claims 25 and 26 have been added. No new matter has been added by these amendments. Support for the amendments can be found throughout Applicant's specification.

Applicant thanks the Examiner for the courtesies extended to Applicant's representative, Brian Pollack, in telephone conferences on various dates concerning patentability of the claims in the instant application. Further to these conferences, Applicant presents evidence in support of the instant application in the form of a Rule 132 Declaration by Dr. Amir Faghri, the sole inventor listed on this application. Applicant respectfully requests reconsideration of the subject patent application in light of the above amendments and below remarks.

I. Claim Rejections

A. Prior Art Rejections Under 35 U.S.C. § 103(a)

In the Office Action, claims 1-5, 8, 10, 13, 14, 19, 23 and 24 were rejected under 35 U.S.C. § 103(a) as allegedly being obvious over U.S. Patent Publication No. 2003/0152821 to Lisi ("Lisi") over Khrustalev et al. ("Khrustalev"). Claims 20-22 were rejected as allegedly being obvious over Lisi and Khrustalev as set forth above in further view of Zuo et al. ("Zuo"). Claims 6, 7, 9, 11 and 12 were rejected under 35 U.S.C. § 103(a) as allegedly being obvious over Lisi and Khrustalev as set forth above in further view of U.S. Patent Publication No. 2004/0146771 to Saito et al. ("Saito") and U.S. Patent Publication No. 2003/0152488 to Tonkovich ("Tonkovich"). Applicant respectfully traverses the rejections.

Applicant previously amended claims 1 and 10 to specify additional structural features generally common to structures known as "heat pipes." While Applicant did not believe that

these amendments were necessary because none of the prior art references disclosed a "heat pipe", they were made nonetheless in order to expedite allowance. In particular, each of claims 1 and 10 were amended to further recite that each heat pipe includes a sealed body containing a working fluid, at least one evaporator section disposed in the sealed body, and at least one condenser section, wherein the heat pipe is configured to transport heat by evaporating working fluid in the evaporator section, and directing the working fluid from the evaporator section to the condenser section where the working fluid is condensed. It will be appreciated that the recitation of "evaporator section" and "condenser section" relate to portions of a heat pipe that are capable of creating a phase change (e.g., liquid to vapor or vapor to liquid, respectively). As such, while a section of a heat pipe can act as an evaporator section at a first point in time, it may later function as a condenser section depending on a variation in environmental thermal conditions.

New claim 25 has been added that is directed to a fuel cell stack having a bipolar plate including a heat pipe disposed between adjacent fuel cells in the stack. Dependent claim 26 has been added to further characterize the heat pipe portion of the fuel cell stack.

It is respectfully submitted that all of the prior art rejections are misplaced, for the simple reason that the prior art fails to describe, teach or suggest a fuel cell system including a heat pipe. It is submitted that a "heat pipe" is patentably distinct from, and not analogous to an active cooling passage, such as that depicted in Lisi or Tonkovich.

In support of this simple distinction, evidence is submitted herewith in the form of a Rule 132 Declaration executed by Dr. Amir Faghri, the sole inventor listed on this application, and a leading expert in the field of heat pipe technology. (Decl. at ¶¶ 2-10).

In particular, it is submitted that heat pipes have certain attributes that distinguish them from conventional active cooling systems. Specifically, by using a heat pipe, it is possible to achieve passive cooling in a fuel cell structure without the need for active cooling. This is an extremely valuable advantage. (Decl. at ¶ 17).

Moreover, use of a heat pipe typically results in an order of magnitude of improvement in performance as compared to a conventional active cooling system, due to phase change. This improvement flows from: (a) high effective thermal conductivity; (b) potential use as a thermal transformer to link energy sources and sinks having different heat fluxes; (c) simple application in power flattening; (d) constant temperature control; (e) design freedom to fit various shapes and configurations; (e) maintenance-free operation for long periods. (Decl. at ¶ 18).

It is submitted that these advantages distinguish "heat pipes" from the cooling systems of Lisi and Tonkovich. As such, the rejections presented are not based on a proper factual foundation. (Decl. at ¶¶ 12, 13 and 16).

For example, in US 2003/0152821 ("Lisi"), it was asserted that the tubular members 102 defining passageways 116 and channels 112 are heat pipes. Tubular members 102 are not heat pipes at all. Instead, passages 102 are fluid flow passages forming a portion of an active cooling system. (Decl. at ¶ 14). Moreover, US 2004/0146771 ("Saito") and US 2003/0152488 ("Tonkovich") do not remedy the deficiencies of Lisi. Specifically, Saito describes a fuel cell separator 1 having a number of ribs 1a that define passages 4 to permit the supply and discharge of hydrogen or oxygen. (Saito, ¶4, Fig. 1). Likewise, Tonkovich is generally directed to laminated devices including micro heating and cooling channels. (Decl. at ¶ 15).

A heat pipe, on the other hand, is fundamentally different from conventional cooling tubes and from the teachings of Lisi, Saito and Tonkovich. Specifically, a heat pipe generally

includes a sealed body containing a working fluid, at least one evaporator section disposed in the sealed body, and at least one condenser section. The heat pipe is typically configured to transport heat by evaporating working fluid in the evaporator section, and directing the working fluid from the evaporator section to the condenser section where the working fluid is condensed. Using a heat pipe in a fuel cell to distribute heat presents certain advantages over prior art systems. (Decl. at ¶ 16).

The rejections in this case are also based on Khrustalev and Zuo. These publications are directed to certain aspects of heat pipes. It is submitted that there is no teaching or suggestion in these documents to combine them with any of the art mentioned above (Lisi, Saito and Tonkovich) to arrive at the claimed invention. In fact, there are certain compelling reasons why this is not obvious at all. (Decl. at ¶ 19).

Lisi operates off of a principle of conventional active cooling. Therefore, modifying Lisi to incorporate a heat pipe in lieu of its conventional tubular members 102 would really change the principle under which Lisi operates. Lisi is therefore not analogous art. Saito and Tonkovich do not remedy this deficiency, and are also not analogous to the invention in this patent application. (Decl. at ¶ 20).

Moreover, it is submitted that there is no teaching or suggestion in the prior art or within the knowledge of one of ordinary skill in the art of fuel cells to combine a heat pipe with a fuel cell as described in this patent application. (Decl. at ¶ 21). A person of ordinary skill in the fuel cell art would have at least a bachelor's degree in chemical or mechanical engineering or other pertinent discipline, and one or more years of experience working with fuel cells. It is submitted that a person at this skill level would not have the requisite knowledge or motivation to combine

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Serial No. 10/632,440

the prior art relied on by the Patent Office in rejecting the claims to arrive at the claimed invention. (Decl. at ¶ 22).

It is further submitted that there has been a long felt, but unresolved, need for passive thermal management in fuel cells to make them more efficient and more commercially attractive. (Decl. at ¶¶ 23-24). It is submitted that use of a heat pipe in a fuel cell to passively manage heat helps to provide a solution for this need. (Decl. at ¶ 24).

Applicant respectfully submits that claims 1-14 and 19-20, and 23-26 define subject matter that is patentably distinct over the prior art of record. Applicant therefore respectfully requests for the rejections under 35 U.S.C. § 102(e) to be withdrawn.

B. Provisional Double Patenting Rejection Over U.S. Serial No. 10/640,122

In the Office Action, claims 1-14 and 19-24 were provisionally rejected on the ground of nonstatutory obviousness-type double patenting as allegedly being unpatentable over claims 1-9 and 19-29 of copending application no. 10/640,122. Applicant respectfully traverses the rejections.

Applicant does not agree with or acquiesce in the double patenting rejection. However, to expedite allowance, a terminal disclaimer is submitted herewith. Applicant therefore respectfully requests for the rejections under 35 U.S.C. § 103 to be withdrawn.

Formal Request For Interview

Applicant believes that an interview to discuss the present rejections and prior art of record would be useful. Thus, Applicant respectfully requests an interview with the Examiner and any other appropriate individual at the Patent Office to discuss the present application and

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Serial No. 10/632,440

the prior art of record. Applicant's attorney of record Brian Pollack may be reached at (203) 353-6876 to schedule a mutually convenient date and time and to provide assistance or additional information if required.

CONCLUSION

Applicant respectfully submits that none of the prior art of record, alone or in combination, discloses or suggests the invention as claimed. Based upon the foregoing, favorable consideration of Claims 1-14 and 19-20, and 23-26 is earnestly solicited. The Director is hereby authorized to charge any deficiency in the fees filed, asserted to be filed or which should have been filed herewith (or with any paper hereafter filed in this application by this firm) to our Deposit Account No. 04-1105, under Order No. 59309(30471).

Respectfully submitted,



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